Saraswati: Newly Discovered Supercluster of Galaxies

A galaxy may be defined as a collection of stars and planets that are pinned in the universe by gravity. A cluster could roughly enclose 1000 to 10000 galaxies. A supercluster could have 40-43 clusters. Our very own Milky Way galaxy is a component of the local group galaxy cluster, which in turn is part of the Laniakea supercluster.

Optical images of the two most massive clusters of the Saraswati supercluster

A supercluster is among the largest-known structures of the solar system. Recently, a team of Indian astronomers from The Inter-University Centre for Astronomy and Astrophysics, Pune, in collaboration with researchers at Indian Institute of Science Education and Research (IISER), Pune; National Institute of Technology, Jamshedpur; and Newman College, Kerala, discovered an extremely massive and large-scale supercluster of galaxies- as big as 20 million billion Suns— which they named as Saraswati — an ancient Indian goddess of knowledge and wisdom. This supercluster is one of the largest known structures in the neighbourhood of the universe, 4000 million light- years away from Earth and roughly more than 10 billion years old. Its mass extends over the scale of 600 million light years.

This wall-like supercluster is shown to be associated with at least 43 massive galaxy clusters and groups, of which a few incredibly large ones constitute its bound and central core region. Only a few such massive superclusters are known at present. The researchers have highlighted the importance of their findings for ongoing cosmological studies of dark energy and the growth of large-scale structures in the universe. This study will be helpful in better understanding the physical processes involved in the growth of such enormous cosmic structures in the distant universe.

These observations will open a new window on the study of large-scale structures in the universe (*Astrophysical Journal* 2017, **844(1)**: 25).

Organic Solar Cells: Superior Life using NiO Films

Organic solar cells (OSC) are third generation photovoltaic devices which have received considerable attention due to their potential for flexible, low-cost photovoltaic devices. However, these devices have very short life times and degrade very fast, hence, not suitable for commercial purposes. Therefore, the prime concern is to improve the device life times without sacrificing the device efficiencies.

Stability concerns have led to the development of better alternatives which employ 'NiO' as hole transporting material in OSCs. NiO is a transition metal preferred because of its stability and better deposition capabilities. Preparation of thin NiO films on a large scale has been a challenge until now.

Recently, Singh et al. from the Indian Institute of Technology, Kanpur, India attempted to overcome this bottleneck by using the technique of inkjet printing. The researchers used NiO as 'ink' and 'paper' was a substrate of glass coated with a material that serves as the positive electrode. They successfully prepared uniform and smooth NiO films as thin as 18 nanometres. For this, they used NiO ink having drops of a particular size, and by providing the substrate with a UV-Ozone treatment before printing. The inkjet-printed NiO film revealed different degrees of transparency at varying temperatures and was able to transmit a maximum of 89% of the light falling on it, by thermally treating the film at 400 ^{o}C.